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The influence of licensing on real estate agents' income: An analysis using propensity score matching

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ABSTRACT

This study explored the influence of real estate licenses on their income. The potential interference of personal attributes was controlled using propensity score matching to reduce selection bias. On average, the matching results showed that the treatment effect was 0.42 indicating that licensed agents had a 42% higher monthly income than unlicensed agents after matching. The regression found that the coefficient of licensing was 0.397 at a 5% significance level. Indeed, licensed agents had a 48.7% higher monthly income than unlicensed agents. This indicates that the monthly income gap between licensed and unlicensed agents was smaller after accounting for the estimation efficiency and including the control variables. The main reason for the large differences between our findings and those of previous studies is the use of regression analysis in the latter. The results suggest that real estate agents should be more aware of the importance of professional licensing for gaining a higher income.

Contribution/Originality: Previous research has explored the relationship between licensing and salary levels, the unique characteristics of the real estate industry and its licensing system mean that few studies have accounted for the selection bias introduced by confounding factors that may influence income levels. To address this, the study applied propensity score matching (PSM) to control for the effects of these factors and minimize selection bias, enabling a more accurate comparison of income differences between licensed and non-licensed agents.

1. INTRODUCTION

Demand for housing and commercial spaces continues to grow due to economic development and increasing urbanization. The real estate market has become a key driver of urban development and economic growth. However, the expanding real estate market has also led to frequent transaction disputes. To establish order in property transactions, protect the interests of clients and promote a sound development of the real estate market, Taiwan announced and enforced the Real Estate Brokerage Management Act in 1999. The act stipulates that real estate agents must pass the national examination and obtain a professional license. This laid the groundwork for the real estate agent licensing system.

The primary responsibility of real estate agents is to facilitate property sales by providing professional advice and services. While licensing is often seen as proof of professional expertise and real estate owners and potential buyers tend to prefer the services of licensed agents, income variation is not solely determined by licensing. In Taiwan, the minimum qualifications for taking the real estate agent examination are being at least 20 years old and having completed senior high school. Over the last five years (2019-2023), approximately 4,000 people took the exam each year with a pass rate of 13.35% (Ministry of Examination, 2024). According to Article 22 of the Real Estate Brokerage Management Act, real estate agents are required to sign specific documents during real estate transactions, leases, and representation including the entrusted contract of the property for sale or rent, an offering document of rental and purchase, a receipt of earnest, a draft of the advertisement of property, and an instruction of property. However, licensing is not strictly enforced in business solicitation making the real estate agent license primarily a certification. Unlike doctors or lawyers, real estate agents have a more flexible income structure. They do not receive a fixed salary but earn income through sales commissions. Therefore, their income is determined by personal competence, business performance and market conditions. Factors such as contextual resources, negotiation skills, marketing abilities and work experience can all influence an agent's business success and, ultimately, their income.

Moreover, the relationship between licensing and income may be influenced by other latent factors and is not entirely dependent on the license itself. Chen, Cheng, Lai, and Hsiao (2015) stated that it is challenging to accurately examine the causal effects of licensing on salary level using observational data. An agent's decision to obtain a license is often influenced by their subjective willingness as well as their expectations for a higher salary in the future. In other words, higher salary expectations may motivate an employee to complete a license examination. A higher salary is not necessarily a result of the direct outcomes of licensing but rather the joint outcomes of licensing and other potential factors. We should control for the differences in personal attributes before licensing to prevent these attributes from interfering with an accurate estimation of the effects of licensing to understand the impacts of licensing on real estate agents' salary levels.

Previous studies have mostly examined the effects of general industry licenses and the number of licenses on salary and income (see (Bailey & Belfield, 2018; Blair & Chung, 2017; Lin, 2011, 2013)). Outside Taiwan, real estate agents with professional expertise and licenses can identify and distinguish objects to obtain more benefits (Khazal & Sønstebø, 2020). Previous studies on the effects of real estate agent licenses on salary and income have mostly used regression analyses (see Lee (2004)) which may not be able to directly capture these effects (Ullah, Sepasgozar, Thaheem, & Al-Turjman, 2021). Furthermore, these studies have often failed to consider the influences of personal attributes (such as inherent capabilities and learning experiences) or environmental and background factors which can lead to baseline differences and self-selection bias in the effects of licensing (Chen et al., 2015). It is necessary to use more appropriate methods to evaluate whether licensing alone results in higher salaries (Chen et al., 2015).

In a nutshell, this study aims to thoroughly examine the net effect of licensing on real estate agents' income within the context of Taiwan's professional real estate licensing system. While previous research has explored the relationship between licensing and salary levels, the unique characteristics of the real estate industry and its licensing system mean that few studies have accounted for the selection bias introduced by confounding factors that may influence income levels. To address this, the study applied propensity score matching (PSM) to control for the effects of these factors and minimize selection bias, enabling a more accurate comparison of income differences between licensed and non-licensed agents. We anticipate that the results will reveal the true impact of licensing on income and help fill theoretical gaps in existing research. The structure of this paper is as follows: The first chapter is the introduction; the second reviews studies related to licensing and income; the third describes the study design, including data sources and the development of the empirical model; the fourth presents the empirical findings and the fifth outlines the conclusion and recommendations.

2. LITERATURE REVIEW

Storey, Watson, and Wynarczyk (1995) found that employees with relevant prior experience and academic achievements are likely to contribute to the future productivity of their companies. This explains why employees with higher education levels and more experience have higher salaries. The literature has highlighted the strong and positive relationship between education level and income (Becker, 2009). Studies from abroad have concluded that as the national education level increases, people are more inclined to obtain higher degrees (see (Ghaffarzadegan, Xue, & Larson, 2017; Tsai, 2010)). However, increasing higher education enrollment rates generates consequences that include degree inflation and devaluation as degrees alone cannot measure an individual's competence. As a result, employers cannot judge a job applicant's competence based solely on their education level (Chen et al., 2015). Gilbukh and Goldsmith-Pinkham (2024) examined the influence of real estate agents' experience on market liquidity. Their findings showed that experienced agents were more efficient in conducting business particularly during downturns in the real estate market.

Howe, Aquilina, and Wilkinson (2023) noted that attaining a license requires a long period of learning and development to substantiate that an individual has the professional skills necessary for their career. Employers in the labor market can judge a person's capabilities not only by their education level but also by the licenses they hold because licensing involves a series of skills assessments. Not only do governments and industry recognize the importance of licenses but some universities also encourage their students to attain licenses to boost their competitiveness in the job market after graduation. Licensing has become an indicator of a person's skills and capabilities. Stokes (2014) demonstrated that students who started working after graduating with a degree or had attained a license in a specific field had significantly higher salaries compared to those who worked before studying for a degree or attaining a license. Pagliero (2010) observed that effectively reducing the pass rate of licensing exams and enforcing stricter licensing requirements would result in licensed professionals having higher salaries. Lin (2011) suggested that the market values of licenses were indistinguishable when classified by type. However, classifying the licenses by level revealed that high-level licenses were significantly associated with higher salaries. Kleiner and Vorotnikov (2017) showed that in 2013, the hourly wages of licensed employees in the United States were 11% higher than those of unlicensed employees. Furthermore, they found that the effects of licensing on salary were more pronounced for high-income employees than for low-income employees. Koumenta and Pagliero (2019) found that the mean effect size of licensing on salary was 4% in the European Union. Zhang (2019) demonstrated that licensed employees in Canada had 9% higher salaries. Howe et al. (2023) noted that practitioners who wanted to practice with a license must complete a five-year period of evaluation and validation, register with an association and apply for indemnity insurance. They argued that these measures reinforce practitioners' professionalism and social responsibility. However, some studies have argued that the effects of licensing on salary are not necessarily positive. For example, Lin (2011) observed that while high-level licenses are conducive to higher salaries, low-level licenses have negative effects. Chen et al. (2015) also found that low-level licenses affect wage hikes instead due to the information these licenses convey. Chen (2011) argued that licensing is a significant indicator of one's professional expertise. Each industry has its preferred license and each license confers its distinct value. Therefore, the professional value of licensing is associated with salary only in a relevant field of work.

The observational data were mostly analyzed using traditional regression analysis in previous studies that examined the influence of licensing on salary levels. The results demonstrated that there were significant differences between the salary levels of employees with and without licenses (Lin, 2011, 2013; Ngo, 2021). Lin and Chan (2018) showed that workers who hold licenses are more likely to earn higher salaries than those without licenses in their study on the effects of social networks, education level, and licensing on the salaries of young workers. This suggests that licensing increases the salary level of young workers. Generally speaking, the abilities of license holders are bolstered by the labor market. Nonetheless, the use of traditional regression in research has certain limitations. First, the results do not accurately estimate the effects of licensing on salary level. For example,

because licensing is not random, the assumptions of linear regression are violated and the model's estimations are biased. Secondly, even if the findings highlight the effects of licensing on salary level, the mean effect size cannot be determined. Finally, self-selection bias may arise due to baseline differences in characteristics between license holders and non-license holders (i.e., personal attributes differ significantly across the two groups) (Chen et al., 2015).

Hummel (2020) suggested that higher urban density leads to increased income. Urban density is defined as the population and housing density within a city. In a study of over 300 metropolitan areas in the U.S., the author found that population and housing density significantly influenced income levels. Similarly, Hirsch, Macpherson, and Qu (2022) noted that people might expect real estate agents to earn more in high-priced markets due to variations in housing prices across different markets. Their findings showed that real estate agents' earnings elasticity with respect to local housing prices was approximately 0.30. In other words, agents' earnings increased by 3% for every 10% rise in housing prices.

Chen et al. (2015) used propensity score matching (PSM) to control for individual baseline differences on the effects of licensing and examined the salary differences between university graduates who hold licenses and those who do not. The study included professional licenses earned through national examinations as well as technical skills and language proficiency certifications. In other words, the author controlled for differences in individual characteristics before licensing to prevent those characteristics from interfering with the estimation of licensing effects. PSM can be used to estimate the mean effect size of licensing on salary levels, the mean effect sizes when license holders do not hold a license and when non-license holders hold a license. Furthermore, there are individual differences between license holders and non-license holders and while these differences are very likely to influence salary levels, they are not necessarily caused by licensing. In the study by Turnbull and Waller (2018) PSM was used to select the sample and perform comparative analyses on specific agents. The findings indicated that agents holding at least 5% of market listings were able to achieve higher prices and faster sales. Holmes and Xie (2018) examined housing sales in Indiana and applied PSM to analyze price differences between out-of-state and local sellers and buyers. Out-of-state sellers and buyers were assigned to the treatment group while local sellers and buyers were assigned to the control group to minimize differences in characteristics. The results revealed that out-of-state buyers were charged 20.4% more than local buyers. However, the price differences were no longer significant suggesting that these price discrepancies were influenced by agents' information asymmetry after using PSM to control for housing attribute variables.

Recent studies have also highlighted that the number and type of licenses should align with a person's academic background and professional expertise to reflect their salary level (Liu, Chen, & Chen, 2022). According to Tao and Hsiao (2013), the quantity of financial certifications is significantly and positively correlated with salary level only when the license holder works in finance and insurance. Subsequent studies have also found that holding a license that aligns with one's professional field has significant positive effects on salary level (Ngo, 2021). This study examined the relationship between professional licensing and salary level among real estate agents.

3. DESIGN

3.1. Propensity Score Matching

PSM is rooted in the principles of counterfactual reasoning of causation. In PSM, the sample population is divided into the following two groups: the treatment group and the untreated control group while ensuring that the remaining covariates are consistent or similar across the groups. In other words, an individual has two responses— one after treatment and one without treatment. However, only one of these responses is observable. Therefore, treatment effects can be defined as the difference between an individual's response after receiving treatment compared to when they do not based on the theoretical foundation of counterfactual reasoning (Benedetto, Head, Angelini, & Blackstone, 2018; Kuan & Lee, 2010; Morgan & Harding, 2006). However, in observational studies, the

treatment effects are often not distributed randomly which results in pre-treatment baseline differences between the experimental and control groups. Furthermore, causal differences arise from endogeneity bias generated by self-selection which affects the estimation of the treatment effect (Kuan & Lee, 2010). In other words, in PSM, there may be several unobserved attributes of the control group that do not match those of the treatment group. This emphasizes the importance of covariate selection during matching (Tam, 2010). To overcome these limitations in causal inference, Rosenbaum and Rubin (1983) proposed PSM as a means to manage the treatment and control groups and ensure that matched variables are similar. This means controlling for the important variables that affect the estimation of causal effects. Nogueira, Pugnana, Ruggieri, Pedreschi, and Gama (2022) have also demonstrated that reweighting in causal inference helps ensure that the covariates are uniformly distributed and more likely to be matched. PSM is a more appropriate method for minimizing bias and differences in this research domain since real estate agents have varying personalities and operate in different markets. In PSM, attributes are matched using suitable indicators to ensure comparability allowing for clearer distinctions between the treatment and control groups (Holmes & Xie, 2018; Ong, Wang, & Chua, 2023; Scofield & Xie, 2019; Sing & Zou, 2024).

PSM involves converting the observable covariates into a single probability (called the propensity score). This score predicts whether an individual is assigned to the treatment group. This propensity score incorporates information from all matched variables making it simpler to do matching and stratification using this single probability rather than matching various variables. The estimated probability is derived through logit regression analysis in which the dependent variable is whether treatment is imposed and the observable covariates serve as the independent variables. However, there is a limitation to PSM when a person in the treatment group has a propensity score of 1 and another person in the control group has a propensity score of 0 (meaning the propensity scores of the experimental and treatment group samples do not overlap), then the person in the treatment group cannot be matched with the person in the control group and this unmatched sample must be discarded (Kuan & Lee, 2010).

When analyzing data using PSM, the first step is to estimate the propensity score through logit or probit analysis. The second step is to select the matching technique. This is followed by checking for common support to ensure that all the matched variables with the same scores have a probability of being distributed to either the treatment or control groups. A sample that only has a probability of being distributed to one group is excluded from the common support and not analyzed. The fourth step is to verify the quality of the matching and the estimated treatment effects. The simplest way of verifying the quality of the matching is to perform t-tests on the matched covariates. The final step is to perform sensitivity analysis (Morgan & Harding, 2006).

3.2. Empirical Model Settings and Variable Definitions
3.2.1. Empirical Model Settings

The variables in model 1 were licensing, sex, age, marital status, having or not having preschool-age children (under six years old) (KID6), education level (EDU1 and EDU2), academic major (DEP), other work experiences (OJOB), job tenure (EXP), work hours (HOUR1 and HOUR2), and business model (TYPE). The model is expressed in Equation 1 as follows:

$$LNINCOME = \alpha_1 + \alpha_2 LICENSE + \alpha_3 SEX + \alpha_4 AGE + \alpha_5 MAR + \alpha_6 KID6 + \alpha_7 EDU1 + \alpha_8 EDU2 + \alpha_9 DEP + \alpha_{10} OJOB + \alpha_{11} EXP + \alpha_{12} HOUR1 + \alpha_{13} HOUR2 + \alpha_{14} TYPE + e \qquad (1)$$

3.2.2. Variable Definitions

The dependent variable in this study was individual performance represented by the logarithm of the average monthly income for the first three months. The independent variable was whether the individual held a real estate agent license. Regarding licensing as a variable, Bailey and Belfield (2018) demonstrated that college-educated American workers who held professional licenses generally had higher incomes and labor force participation rates.

The study also found that after controlling for licensing, on average a college degree reduced the salary effects by 2% to 3%. This means that professional licensing reduced salary disparities among college-educated workers. A study by Gittleman, Klee, and Kleiner (2018) also concluded that license holders earned higher salaries and were more likely to be employed and receive health insurance coverage from their employers. However, Lee (2004) argued that license holders do not necessarily have higher average incomes. This may be attributable to the recent enactment of the Real Estate Broking Management Act of Taiwan during the study period meaning its short-term effects were not easily observed. In this study, we designed real estate agent licensing as a dummy variable in which licensed agents (treatment group) were assigned a value of 1 while unlicensed agents (control group) were assigned a value of 0 and the coefficient was expected to be positive. The descriptions of the variables are presented in Table 1.

Regarding sex as a variable, Chang (2023) used data from 1999 to 2005, when there were no regulations on sex-based salary differences to study salary adjustments following the enactment of gender equality regulations. The findings indicated that sex-based salary disparities did exist as women were paid less than men. Wu (1988) examined changes in the gender distribution across industries in Taiwan before 1985. The results showed that most industries in Taiwan were unfavorable to women because of the physical demands of jobs such as manufacturing. However, as technology and machinery improved, these jobs became less physically demanding, providing both sexes increasingly equal employment opportunities. Moreover, changes in industrial technologies and higher educational levels among women facilitated gender parity in the labor market. Wu and Hsu (2012) found that male real estate agents had higher levels of emotional intelligence compared to female real estate agents. In this study, sex was designed as a dummy variable in which men were assigned a value of 1 while women were assigned a value of 0 and the coefficient was expected to be positive.

Regarding age as a variable, Zacher and Frese (2011) observed that as employee age, both their internal resources and their external job resources such as training and development and organizational support decrease. Consequently, they are unable to achieve the same level of performance as before and are less willing to pursue opportunities. Veríssimo, Verhaeghen, Goldman, Weinstein, and Ullman (2022) noted that older employees' self-efficacy and work motivations were negatively affected by poorer job competence or performance. Kooij, Bal, and Kanfer (2014) noted that employees age have a decreased future time perspective which further reduces their motivation to continue working. In this study, we expected a positive coefficient for the effects of age on salary level.

Regarding marital status as a variable, Eckstein, Keane, and Lifshitz (2019) analyzed U.S. population data from 1935 to 1975 and found that married men and women generally had higher salary levels and salary growth rates than single men and women. Subsequent studies have also found that married employees have relatively higher education levels compared to single employees and that individuals with higher education levels and therefore stable incomes are financially more willing to start a family. Furthermore, numerous studies have shown that work-family balance is key to minimizing role conflict in employees. Work-family conflict reduces an individual's job satisfaction (Hsieh & Chen, 2022; Rahman, Ali, Jantan, Mansor, & Rahaman, 2020). In this study, marital status was designed as a dummy variable with two categories: married, single and others serving as the baseline for comparison. The coefficient was expected to be positive or negative.

Regarding using having or not having preschool-age children (below the age of six) as a variable, Perreault and Power (2023) highlighted that employees with job responsibilities are likely to encounter conflicting roles, which can result in mental stress and strained interpersonal relations. Some participants in Ng's (2019) study expressed that they had no desire to have children as it would be detrimental to their careers. Yen (2018) found that ill-conceived family caregiver leave policies not only generate short-term financial difficulties among childbearing women and those with young children but also limit their salary growth. Some studies have identified the ages and number of young children as factors that influence women's workforce participation (Eckstein et al., 2019). In this

study, we designed having or not having preschool-age children as a dummy variable in which having preschool-age children was assigned a value of 1 while not having preschool-age children was assigned a value of 0 and the coefficient was expected to be negative.

Regarding education level as a variable, there is a growing trend of employees pursuing higher-level degrees in order to compensate for their lack of professional expertise (Ghaffarzadegan et al., 2017; Tsai, 2010). Most studies have found that in the United States, the salary gap between workers holding a college degree and those without one is widening which is attributed to the increasing demand for technical skills in the labor market (Eckstein et al., 2019; Stokes, 2014). The social contributions of university graduates nowadays differ from those in the past due to the expansion of higher education in Taiwan. According to Hsu (2021) workers who held a senior high school diploma and above were more likely to find jobs that fit their education level but workers who held a university degree and above only had a job fit ranging from 8% to 22%. This means that workers with a higher education level do not necessarily find jobs commensurate with their education level. Studies from outside Taiwan have also noted that a higher human capital stock results in higher workforce productivity (Becker, 1992, 2009). According to the efficiency wage theory, an individual's salary level reflects their competence and there is a strong relationship between education level and individual competence competent people enjoy higher returns on education, and vice versa. For example, studies by Pereira and Martins (2002) and Eckstein et al. (2019) yielded similar results. In this study, education level was categorized into the following three groups: vocational or senior high school diploma, junior college or university degree, and postgraduate degree, with vocational or senior high school diploma as the baseline for comparison. Two dummy variables were designed: In EDU1, postgraduate degree holders were assigned a value of 1 while others were assigned a value of 0; in EDU2, junior college and university degree holders were assigned a value of 1 while others were assigned a value of 0. The coefficient was expected to be positive.

Regarding academic majors as a variable, Lin and Hung (2019) emphasized that the most desired outcome in national education and the labor market is that employees are working in their field of study. The existence of a skills gap in the market is widely acknowledged. Socioeconomic researchers have concluded that a discrepancy between a company's human capital and required work skillset leads to job dissatisfaction, lower productivity, and lower job engagement among workers. Moreover, the company would incur additional costs to repeatedly recruit, select and train new employees (Ermini, Papi, & Scaturro, 2017). In this study, the academic major was designed as a dummy variable and consisted of real estate-related fields and non-real estate-related fields. Graduates from real estate-related fields were assigned a value of 1 while graduates from non-real estate-related fields were assigned a value of 0. The coefficient was expected to be positive.

Regarding having other work experiences as a variable, newcomers with extensive work experience in related fields can leverage this experience to quickly adapt to their new work environment and achieve positive outcomes in their new job (Van Iddekinge, Arnold, Frieder, & Roth, 2019). According to Van Iddekinge et al. (2019) job standards and skill requirements differ across industries and therefore, having other work experiences does not necessarily increase a worker's salary level. In this study, having work experience outside of real estate brokerage was assigned a value of 1 while not having work experiences outside of real estate brokerage was assigned a value of 0. The coefficient was expected to be positive or negative.

Regarding job tenure as a variable, previous studies have demonstrated the positive effects of job tenure on career outcomes (see (Awan et al., 2021)). Workers with greater knowledge, skills and other competencies achieve better results at work (Harris, Pattie, & Mcmahan, 2015). Silva and Galbraith (2018) noted that the longer a person works in a specific department, the more likely they are to negotiate a higher salary. In other words, an employee's likelihood of negotiating a higher salary increases with their job tenure in a specific field of work. In this study, we expected job tenure to have a positive effect on salary.

Regarding work hours as a variable, Lee (1999) and Sheer and Rice (2017) concluded that employees with longer daily work hours are more engaged with their jobs and perform better. However, some studies have argued

that longer work hours decrease job performance (Nayak & Pandey, 2022). Lin, Wu, Ma, and Lan (2019) also found that long work hours reduce employees' quality of life and may even pose health risks. Furthermore, Kuo and Wang (2020) observed that many employers have implemented the exempt employment system, shift work, or compensatory leave policies which result in employees working overtime and facing increased stress. Real estate agents are exempt employees and often work longer hours to increase their pay, thus tiring themselves out. In this study, work hours were designed as a dummy variable expressed as the average daily work hours over the last three months. It included categories of less than 40 hours, 41-70 hours, and more than 71 hours with 40 hours serving as the baseline for comparison. Two dummy variables were designed: in HOUR1, those who worked more than 71 hours were assigned a value of 1 while others were assigned a value of 0; in HOUR2, those who worked between 41 and 70 hours were assigned a value of 1 while others were assigned a value of 0. The coefficient was expected to be positive or negative.

Table 1. Descriptions of the variables.

Variables	Description	Expected symbol
Average monthly income (LNINCOME)	Expressed as the logarithm of the average monthly income for the first three months.	/
Licensing (License)	A dummy variable in which licensed agents were assigned a value of 1 while unlicensed agents were assigned a value of 0.	+
Sex (sex)	A dummy variable in which men were assigned a value of 1 while women were assigned a value of 0.	+
Age (age)	A continuous numeric variable expressed as a real estate agent's current age.	−
Marital status (MAR)	A dummy variable in which married real estate agents were assigned a value of 1 while single agents were assigned a value of 0.	+/−
Having or not having preschool-age children (Under six years old) (KID6)	A dummy variable in which real estate agents who have preschool-age children were assigned a value of 1 while those who do not were assigned a value of 0.	−
Education level (EDU)	The education levels considered were vocational or senior high school diploma, junior college or university degree, and postgraduate degree. The vocational or senior high school diploma group was used as the baseline for comparison. There were two dummy variables: in EDU1, postgraduate degree holders were assigned a value of 1 while others were assigned a value of 0; in EDU2, junior college and university degree holders were assigned a value of 1 while others were assigned a value of 0.	+
Academic major (DEP)	A dummy variable in which real estate agents who graduated from real estate-related fields were assigned a value of 1 while those who graduated from other fields were assigned a value of 0.	+
Other work experiences (OJOB)	A dummy variable in which real estate agents with work experiences other than real estate brokerage were assigned a value of 1 while those without such work experience were assigned a value of 0.	+/−
Job tenure (EXP)	A continuous numeric variable that expresses a real estate agent's current job tenure in the real estate brokerage industry.	+
Work hours (Hour)	Defined in this study as the average work hours per day over the last three months, the categories considered were less than 40 hours, 41-70 hours and more than 71 hours, with 40 hours as the baseline for comparison. There were two dummy variables: in HOUR1, real estate agents who worked more than 71 hours were assigned a value of 1 while others were assigned a value of 0; In hour2, agents who worked between 41 and 70 hours were assigned a value of 1 while others were assigned a value of 0.	+/−
Business model (Type)	A dummy variable in which direct sales stores were assigned a value of 1 while franchises were assigned a value of 0.	+/−

Regarding business model as a variable, it is important to note that Taiwanese real estate companies operate using three models: direct sales, franchises and freestanding stores. Chen et al. (2015) observed that because direct sales stores have more resources and funds, they are capable of developing more robust employee training systems tailored to their human resource requirements. Franchises have different methods of recruiting employees. Candidates are not screened by education level but rather evaluated based on their performance after recruitment. Furthermore, Lee and Shen (2008) found that real estate brokers' perceptions of organizational formalization and integration vary depending on the business model. In terms of transaction security and service quality, direct sales stores are expected to perform better than franchises. In this study, the business model was designed as a dummy variable in which direct sales stores were assigned a value of 1 while franchise stores were assigned a value of 0. The coefficient was expected to be positive or negative.

3.3. Questionnaire Design and Data Collection

The first section of the questionnaire covered the participants' basic information such as licensing, sex, age, marital status, whether or not they have preschool-age children, education level and academic major. The second section covered job-related variables such as whether or not they had other work experiences, job tenure, and daily work hours. The third section covered company-related variables such as the company's business model. The real estate agents' business performance was represented by their average monthly income over the previous three months which was calculated as the total of their base salary, incentives and benefits. The study questionnaire is included in Appendix 1.

The data for this study was collected by administering in-person questionnaires at the branch offices of real estate brokerage companies located in Kaohsiung City. These branch offices were located from listings on the companies' websites.

As of April 2022, there were 342 real estate branch offices in Kaohsiung City: Taiching Realty Inc. had 112 offices, Yungching Realty Inc. had 58 offices, U-Trust Realty had 19 offices, H&B Housing had 77 offices, Sinyi Realty had 39 offices, Chinatrust Real Estate Co. had 12 offices, Taiwan Realty had 15 offices, and Eastern Realty had 10 offices. We delivered 10 questionnaires to each of the selected branch offices: 34 from Taiching Realty Inc., 17 from Yungching Realty Inc., six from U-Trust Realty, 24 from H&B Housing, 11 from Sinyi Realty, four from Chinatrust Real Estate Co., five from Taiwan Realty, and three from Eastern Realty. [1]

To increase the response rate, we delivered the questionnaire to the offices twice, in May and June 2022, providing 500 copies each time, for 1000 copies. Of these, we received 557 responses. After removing the invalid and incomplete responses (including those that did not respond to the questions appropriately), 354 valid responses remained indicating an effective response rate of 35.4%.

4. RESULTS

4.1. PSM

The samples in this study were matched one-to-three and covariate balancing was performed to verify whether the assumption of balance was satisfied. According to Table 2 and Figure 1, after matching, there were no significant differences between the treatment and control groups in terms of age and tenure. The standardized

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[1] Source: Websites of the real estate brokerage companies in Kaohsiung City in April 2022.

https://www.taiching.com.tw/ store/store; https://shop.yungching.com.tw/ region; http://www.u-trust.com.tw/CF2/CF0301.asp?ADDCounty;

https://www.hbhousing.com.tw/franchise/?city=/; https://www.sinyi.com.tw/stores;

https://www.cthouse.com.tw/about/franchise/%E9%AB%98%E9%9B%84%E5%B8%82-city/; https://www.etwarm.com.tw/company/stores 。Last accessed on April 2, 2022.

biases (% bias) of age and tenure decreased significantly after matching and were more condensed indicating that the matching process was successful. The standardized bias also reflects the differences in the bias between the treatment and control groups. A greater difference before and after matching indicates a higher percentage change, meaning that the difference between the two groups on the specified variable is low and that the matching outcomes are excellent. Table 3 shows the results of the chi-squared tests for the categorical variables. There were no significant differences between the two groups in terms of sex, marital status, education level or business model, and the distribution of these variables within the two groups was homogenous.

Table 2. PSM covariate balancing test results.

Independent variables	Samples	Bias (%)	% Reduction in |bias|	t	p
Age	Unmatched	40.8		3.70	0.000***
	Matched	4.4	89.3	0.35	0.726
Tenure	Unmatched	12.4		1.15	0.252
	Matched	-2.2	82.4	-0.17	0.866

Note: Unmatched denotes before matching. Matched denotes after matching. *** denotes a 1% level of significance.

Table 3. Chi-squared test results before and after matching.

Independent variables	Samples	Chi-square value	p-value
Sex (Sex)	Unmatched	2.0153	0.156
	Matched	0.2645	0.607
Marital status (MAR)	Unmatched	3.0023	0.083*
	Matched	0.0586	0.809
Education level (EDU1)	Unmatched	0.1333	0.715
	Matched	0.9796	0.322
Education level (EDU2)	Unmatched	1.7310	0.188
	Matched	0.6723	0.412
Business model (Type)	Unmatched	20.6066	0.000***
	Matched	2.4823	0.115

Note: Unmatched denotes before matching. Matched denotes after matching. * denotes a 10% level of significance. *** denotes a 1% level of significance.
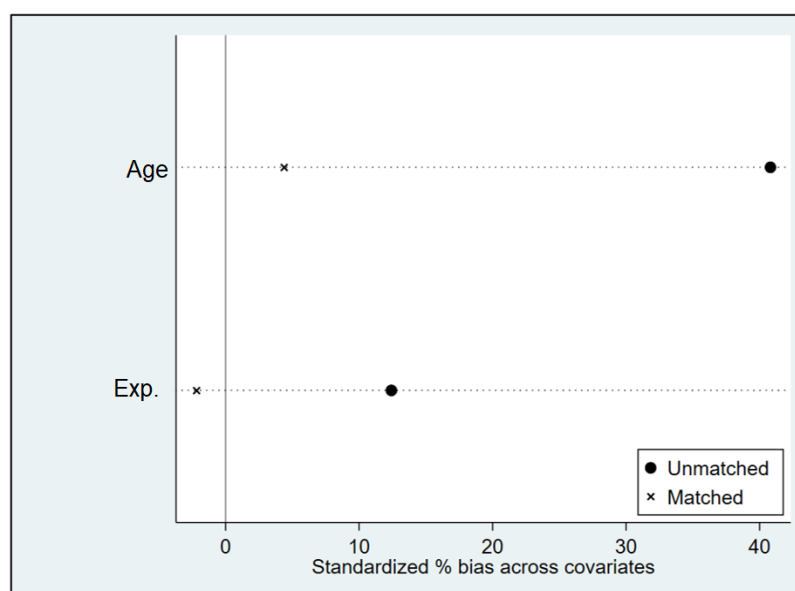

Figure 1. Distribution of the standardized bias before and after matching.

Figure 2 presents the common support of the treatment and control groups. The majority of the control group was within the common support with several samples of off-support. The treatment group was fully within the common support. Before matching, this study had a sample size of 354. There were 352 samples matched and analyzed after removing the off-support control group samples.
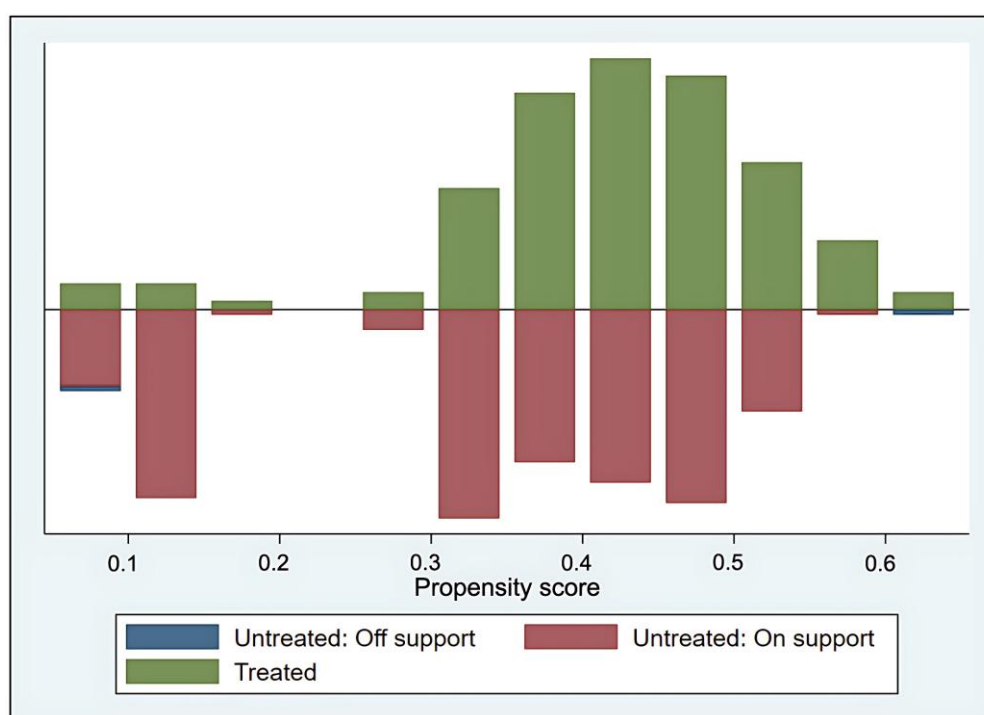
Figure 2. Common support of the propensity scores.

Table 4 compares the average treatment effect on the treated (ATT) between the control and treatment groups. The dependent variable is the logarithm of average monthly income. The results after matching indicate that the ATT for monthly income between licensed and unlicensed agents was 0.42. This means that after matching, licensed agents had a 42% higher monthly income than unlicensed agents.

Table 4. Comparison of the ATT for monthly income between the two groups.

Treat	Sample	Treated	Controls	Difference	S. E	T-stat
Licensing	Unmatched	11.35	11.02	0.33	0.10	3.28
	ATT	11.35	10.93	0.42	0.12	3.49

4.2. Description of the Sample Statistics

First, we will describe the matched samples. In terms of the participants' demographics, licensed agents comprised 44.4% of the sample while unlicensed agents accounted for 55.6%. Male real estate agents accounted for 57.3%, while female agents accounted for 42.7%. The agents' ages ranged from 21 to 73 years with a mean age of 42.6. Married agents comprised 54.8% of the sample while single agents accounted for 45.2%. Agents with preschool-age children constituted 7.5% while those without made up 92.5%. Agents with a vocational or senior high school diploma accounted for 25.4% of the sample, those who graduated with a junior college or university degree accounted for 70.3%, and those who received a postgraduate degree accounted for 4.3%. The majority of agents received a junior college or university education. Agents who majored in real estate-related fields accounted for 9.8% of the sample. This relatively low percentage compared to other academic backgrounds may be due to the limited number of real estate-related academic programs in Taiwan.

Real estate agents who have other work experiences comprised 78.8% of the sample. The agents' job tenure ranged from 0.1 to 37 years with an average tenure of 7.07 years. Most of the agents or 51.3% of the sample, worked between 41 and 70 hours followed by 26.7% that worked less than 40 hours and 22% that worked more than 71 hours. Direct sales stores accounted for 91.4% of the sample, and franchises accounted for 8.6% with regard to the companies' business models. The data of the entire sample is provided in Appendix 2. The descriptive statistics of the control and treatment groups after matching are in Appendix 3.

5. DISCUSSION

The empirical results of this study are presented in Table 5. The F-statistic of model 1 was 7.90 and was statistically significant with an adjusted R^2 of 0.077. This shows that the model was a good fit. We used the variance inflation factor (VIF) to assess the severity of multicollinearity and address possible bias from multicollinearity between the dependent and independent variables in the estimated model coefficients. Aside from the VIFs of HOUR1 and HOUR2 which were larger than 10, all the VIFs of the other independent variables were lower than 10, indicating the absence of severe multicollinearity. We also addressed the issue of heteroscedasticity. White (1980) recommended using robust standard errors for large samples regardless heteroskedastic errors between the error terms. If heteroskedastic of errors are present using robust standard errors can prevent incorrect interval estimations and statistical test results. Therefore, we used robust standard errors for assumption testing.

The estimation results showed that the estimated coefficient of licensing was 0.397 at a 1% level of significance. This means that licensed agents had a 48.7% higher (e^α-1 conversion) monthly income than unlicensed agents. In a previous study on this issue, Bailey and Belfield (2018) found that college-educated American workers who held professional licenses generally had higher incomes and labor force participation rates. Similarly, Gittleman et al. (2018) also found that license holders earned higher salaries and were more likely to be employed and receive health insurance coverage from their employers. The results of this study after applying PSM showed that the ATT was 0.42, indicating that licensed agents had a 42% higher monthly income compared to unlicensed agents. The regression analysis showed that licensed agents' monthly income was 48.7% higher than unlicensed agents. This means that after considering the estimation efficiency and accounting for the control variables, the monthly income gap between licensed and unlicensed agents decreased. The main reason for the large differences between our findings and those of previous studies is the use of regression analysis in the latter.

The estimated coefficient of age was -0.018 with a 1% level of significance. This means that as age increases, monthly income falls. This aligns with the findings of Veríssimo et al. (2022) who noted that older employees often experienced reduced self-efficacy and work motivation resulting from declining job competence or performance. Research indicates that as employees age, their individual resources (such as time, competence, and health) and external job resources (such as training and development resources) decrease. Consequently, it is difficult for middle-aged and older employees to achieve high job performance (Veríssimo et al., 2022). The estimated coefficient of marital status was 0.240 with a 10% level of significance. This means that married real estate agents had a 27.1% higher (e^α-1 conversion) average monthly income than single agents. This aligns with the findings of Eckstein et al. (2019) who showed that a majority of married employees have higher education levels and therefore knowledge and professional skills that make them more productive. The estimated coefficient of tenure was 0.035 with a 1% level of significance indicating that tenure has a significant and positive influence on monthly income. Previous studies have also demonstrated the positive effects of job tenure on career outcomes (see (Awan et al., 2021)). Silva and Galbraith (2018) showed that the longer an employee works in a specific department, the more likely they are to negotiate a higher salary. To put it another way, the likelihood of salary negotiation increases with an employee's job tenure in a specific field of work. The estimated coefficient of the business model was -0.229, with a 10% level of significance. This means that employees of direct sales stores earned an average of 20.5% less in monthly income than employees of franchise stores. This difference may result from the different recruitment strategies used in franchising in which candidates are not screened by education level but rather evaluated on their professional performance after recruitment.

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Table 5. Regression analysis results.

Variables	Estimated coefficient	Robust standard error
Cons	11.251***	0.276
License	0.397***	0.113
Sex	-0.086	0.112
Age	-0.018***	0.007
MAR	0.240*	0.132
KID6	-0.00002	0.0002
EDU1	0.061	0.236
EDU2	0.198	0.129
DEP	-0.00008	0.0004
OJOB	0.0001	0.0002
EXP	0.035***	0.009
Hour1	-0.032	0.076
Hour2	0.032	0.076
Type	-0.229*	0.132
F	7.90	
R2	0.120	
Adjusted R2	0.077	
N	279	

Note: * denotes a 10% level of significance. *** denotes a 1% level of significance.

6. CONCLUSION AND RECOMMENDATIONS

6.1. Conclusion

This study thoroughly examined the net effects of licensing on the income level of Taiwanese real estate agents. We analyzed the data collected from real estate agents working in 10 administrative districts in Kaohsiung City, Taiwan, including Sanmin, Lingya, and Xinxing. We applied PSM to reduce the interference of selection bias. The results revealed that licensed agents had a significantly higher income level than unlicensed agents. This finding indicates that similar to the benefits of licensing in other industries holding a professional real estate license positively influences the salary level of real estate agents. Furthermore, after accounting for the estimation efficiency and including the control variables, the monthly income gap between licensed and unlicensed agents was reduced. This shows that the confounding effects of selection bias magnify the impact of licensing on salary. Neglecting these potential confounders may result in an overestimated impact of licensing on salary.

Based on the study results, real estate agents should recognize the importance of professional licensing to increase their income. Licensing is not only an effective marketing tool but it also enhances clients' perception of an agent's professional image and trustworthiness. A license boosts an agent's competitiveness in the job market, attracts more clients and improves business performance and income levels. These findings can motivate non-licensed agents to focus on career development by actively participating in professional training programs and examinations to advance their skills. For policymakers, a strong licensing system promotes the professionalism of real estate agents and helps reduce transaction disputes.

6.2. Limitations

The questionnaires were administered during the COVID-19 pandemic, when many real estate companies' branch offices were closed. In addition, due to staffing restrictions, there were fewer agents working at the offices. Therefore, the questionnaire response rate was below our expectations.

6.3. Suggestions

This study focused on Kaohsiung City in Taiwan as the study area. Multiple factors may influence the income of real estate agents due to variations in the real estate market across different cities or regions.

Future research should consider expanding the sample to include other cities or regions in Taiwan to increase the generalizability and representativeness of the results as well as to compare the benefits of licensing across different areas. Additionally, the questionnaire did not cover all potential factors influencing real estate agents' income such as professional skills and business networks which may limit the study's understanding of income determinants. More variables related to branch offices such as office size, length of operation, location, business volume, or transaction volume could also have been included to enhance the study's depth and accuracy. In terms of empirical methods, future research could apply hierarchical linear modeling to examine the joint effects of organizational and personal attributes as well as the relationships between these factors, thus offering broader perspectives for future studies.

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APPENDICES

Appendix 1. Study questionnaire.

(1) Personal details

1.   Please state your sex: □ Male □ Female

2.   Please state your year of birth: _____.

3.   Please state your marital status: □ Married □ Single □ Other

4.   Do you have any children?

(1) □ No (2) □ Yes; if so, are your children aged six years or younger? □ No □ Yes

5.   Please state your education level.

□ Vocational/senior high school diploma or below □ Junior college degree (Two-year and five-year programs) □ University degree (Including two-year, four-year and technical programs) □ Postgraduate degree

6.   Please state your academic major.

□ Real estate (Including land economics, land management, urban planning, real estate development) □ Language and law □ Business and management □ Science and engineering □ Agriculture and medicine □ Home economics □ Other

7.   Have your worked in other fields aside from real estate brokerage?

(1) □ No (2) □ Yes, in _____.

8.   Do you possess a real estate agent license? (1) □No (2) □Yes (Proceed to the next question)

9.   What was your primary motivation for taking the real estate agent license exam? (Select one response)

□ Majored in the field □ Personal interest and values □ P roof of expertise

□ Company's requirement □ Higher wages □ Improving competitiveness □ Legally obtaining signing authority □ Other, specify:_____

10.   What do you perceive as the greatest difference before and after attaining your real estate agent license? (Select one response)

□ More authority □ Higher wages □ Increased productivity □ More competitive advantage □ More responsibility □ Other, specify:_____

11.   What was your primary motivation for working in real estate? (Select one response)

□ Majored in the field □ Personal interest and values □ Favorable working conditions □ Good wages □ Flexible work hours □ Other, specify: _____

(2) Current job status

1.   How long have you worked in the real estate brokerage industry?_____ years.

2.   What is your current job position?

□ Store manager □ Agent □ Sales associate □ Management associate □ Administrator □ Other

3.   What is your branch office's business model? □ Direct sales □ Franchise

4.   How many employees are there at your branch office? □ 10 or fewer □ 11－20 □ 21－30 □ 31－40 □

41－50 □ 51 or more

5.   Do the employees at your branch offices receive a base salary?

(1)   □ No □ Yes, NT$_____ per month.

6.   What was your average monthly group incentive percentage over the last three months? (leave blank if none) _____%

7.   What was your average monthly individual incentive percentage over the last three months?

_____%

8.   What was your average monthly sales revenue over the last three months?

Around NT$ _____ (Example: If the commission rate is 6% for average monthly transactions of NT$15 million over the last three months, then the sales revenue, or commission, would be NT$900,000).

9.   What was your average monthly sales incentive over the last three months?

Around NT$ _____ (Example: If the commission was NT$900,000, and the individual incentive rate is 30%, then the average monthly commission would be NT$270,000).

10.   What was your average monthly income over the last three months (including base salary, incentives, benefits)?

Around NT$_____.

11.   What was your average monthly total sales over the last three months?

Around NT$_____.

12.   What was your average monthly sales volume over the last three months?

Around _____ units.

13.   Are your required by your company to achieve a specific sales target every month?

(1)   □ No (2) □ Yes, NT$ _____ per month.

14.   Please state the average number of hours you work per week.

□ 40 hours or less □ 41 - 50 hours □ 51 - 60 hours □ 61 - 70 hours □ 71 - 80 hours □ 81 - 90 hours □ 91 -

100 hours □101 hours or more

15.   What is your main strategy for finding clients? (choose as many as apply) □ Advertising (online and other platforms) □ Introductions by friends and family □ Door-to-door visits □ Phone calls □ Client appointment □ Distributing flyers □ Through mail

16.   Based on your experience, when you and your colleagues receive a task at the same time, would your colleagues attempt to snatch the task from you? □ Absolutely not □ Usually not □ Neutral □ Sometimes □ Absolutely will

17.   Based on your experience, when you and your colleagues receive a task at the same time, would you actively push for the task?

□ Absolutely not □ Usually not □ Neutral □ Sometimes □ Absolutely will

18.   Does the competition between you and your colleagues motivate you to be more productive in your work?

□ Never □ Usually not □ Neutral □ Sometimes □ Absolutely does

19.   How satisfied are you with your achievements and contributions in the group?

□ Very dissatisfied □ Dissatisfied □ Neutral □ Satisfied □ Very satisfied

20.   Do employees at your branch office receive benefits? □ No (2) □ Yes (Proceed to the next question)

21.   How satisfied are you with the benefits provided by your branch office?

□ Very dissatisfied □ Dissatisfied □ Neutral □ Satisfied □ Very satisfied

22.   How satisfied are you with the incentive system at your branch office? (An incentive system is the additional remuneration provided by the company, including the individual incentive, group incentive and bonuses) □ Very dissatisfied □ Dissatisfied □ Neutral □ Satisfied □ Very satisfied

23.   How satisfied are you with the work environment at your branch office? (A work environment includes the overall work atmosphere, supervisors' attitudes toward subordinates, turnover rate, peer relations, office rules, etc.)

□ Very dissatisfied □ Dissatisfied □ Neutral □ Satisfied □ Very satisfied

24.   Did anyone guide or mentor you when you first began working at your company? (1) □ No (2) □

Yes, if so, would you agree that the guidance was helpful for your work? □ Completely disagree □ Disagree □ Neutral □ Agree □ Completely agree

Appendix 2. Descriptive statistics of the sample after matching (n=279).

Variable		Number of respondents	Valid percentage
Real estate agent license	Yes	124	44.40%
	No	155	55.60%
Sex	Male	160	57.30%
	Female	119	42.70%
Marital status	Married	153	54.80%
	Single	126	45.20%
Preschool-age children (Under six years of age)	Have preschool-age children	235	92.50%
	Do not have preschool-age children	19	7.50%
	Missing values	25	
Education level	Vocational/Senior high school diploma	71	25.40%
	Junior college or university degree	196	70.30%
	Postgraduate degree	12	4.30%
Academic major	Real estate-related fields	27	9.80%
	Non-real estate-related fields	249	90.20%
	Missing values	3	
Other work experiences	Yes	219	78.80%
	No	59	21.20%
	Missing values	1	
Work hours	40 hours or less	74	26.70%
	41-70 hours	142	51.30%
	71 hours or more	61	22%
	Missing values	2	
Business model	Direct sales	24	8.60%
	Franchise	255	91.40%
Variable	Minimum	Maximum	Mean	Standard deviation
Age	21	73	42.63	11.9
Job tenure	0.1	37	7.07	7.57
Monthly income	2,000	2,000,000	112,775.81	179,268.64

Appendix 3. Descriptive statistics of the control and treatment groups after matching (n=279).

Variable		Control group (N=155)		Treatment group (N=124)	
		Number of respondents	Valid percentage	Number of respondents	Valid percentage
Sex	Male	91	58.7%	69	55.6%
	Female	64	41.3%	55	44.4%
Marital status	Married	84	54.2%	69	55.6%
	Single	71	45.8%	55	44.4%
Preschool children (Under six years)	Have preschool-age children	128	90.1%	107	95.5%
	Do not have preschool-age children	14	9.9%	5	4.5%
	Missing values	13			
Education level	Vocational/Senior high school diploma	38	24.5%	33	26.6%
	Junior college or university degree	112	72.3%	84	67.7%
	Postgraduate degree	5	3.2%	7	5.6%
Academic major	Real estate-related fields	11	7.1%	16	13.1%
	Non-real estate-related fields	143	92.9%	106	86.9%
	Missing values	1		2	
Other work experiences	Yes	124	80.5%	95	76.6%
	No	30	19.5%	29	23.4%
	Missing values	1			
Work hours	40 hours or less	41	26.8%	33	26.6%
	41-70 hours	81	52.9%	61	49.2%
	71 hours or more	31	20.3%	30	24.2%
	Missing values	2			
Business model	Direct sales	17	11%	7	5.6%
	Franchise	138	89%	117	94.4%

	Control group (N=155)				Treatment group(N=124)			
	Minimum	Maximum	Mean	Standard deviation	Minimum	Maximum	Mean	Standard deviation
Age	21	72	41.81	12.217	21	66	43.65	11.452
Job tenure	0	37	7.067	7.5757	0	34	7.065	7.5828
Monthly income	2000	1000000	86913	112527	10000	2000000	145105	234276